memorandum

T10/05-377r1

To	From	Subject	Date
INCITS T10 Committee	Michael Banther, HP	ADT-2 Negotiable Time-Outs	6 July 2006

Revision History

Revision 0 – Initial document.

Revision 1 – Changes to the timeout formula. Provide asymmetric timeouts using new link service information units.

Related documents

Automation/Drive Interface – Transport Protocol – 2 (ADT-2), T10/1742-D, revision 2, 15 May 2006.

Background

During the development of ADT, the ADI working group sought to find a formula for the acknowledgment time-out that would suit all of the known connection strategies used between existing automation devices and DT devices. Short time-out values favor time-division multiplexing connections between one automation device and several DT devices. Longer time-out values favor continuous connections between one automation device and one DT device or event-driven multiplexing connections between one automation device and several DT devices.

Experience has shown that the acknowledgement time-out formula chosen for ADT does not provide the flexibility desired by automation device developers. HP proposes replacing certain constants in the existing formula with negotiable parameters to allow run-time customization to the acknowledgement time-out value chosen.

Changes to the ADT-2 draft standard

3.1.22 link parameters: The parameters affecting the physical operation of the link, including but not limited to maximum ACK offset, maximum payload size, ~~and~~ baud rate, time-out coefficient, and time-out constant.

3.1.27 login process: The process of ~~negotiating~~ establishing negotiated operating parameters for the transport using Port Login IUs (see 4.3.3).

3.1.X negotiated operating parameters: The current link parameter values agreed upon through negotiation under which the port is operating.

4.2 Default operating parameters

The default operating parameters for a port are as follows:

    a) The baud rate shall be set to 9 600;

    b) the ACK offset shall be set to 1; ~~and~~

    c) the Maximum Payload size shall be 256 bytes~~.~~;

    d) the time-out coefficient shall be set to 2; and

    e) the time-out constant shall be set to 1.

~~These values shall remain in effect until the login process is complete, at which time the negotiated values shall take effect.~~

4.3.2.4 P2:Logged-In

4.3.2.4.1 State description

Upon entry to this state, a port shall set its negotiated operating parameters to the value of the negotiated ~~values~~ parameters (see 4.3.2.3.1).

4.3.3.7 N4:Agreed state

4.3.3.7.1 State description

A port enters this state if it is the second port to accept the negotiated operating parameters.

4.6.1.2.2 Acknowledgement IU time-out

The sender of a frame, other than an acknowledgement IU, shall time-out the resulting acknowledgement. It shall be considered an error condition if a corresponding acknowledgement IU is not received within the time-out period. The time-out period shall start after the EOF of the frame has been sent. When operating with a maximum ACK offset greater than one, a port may start the time-out period for a frame that has completed transmission after the acknowledgement IU for a previously sent frame has been received. The minimum acknowledgement IU time-out period shall be calculated using the formula in figure 9.

$Timeout_{ACK} = (Timeout_{COEFF} * Period $ ~~* Size_{MAX} * 2~~ $) $ + $*$ ~~(Period *~~ $(Size_{MAX} + (Offset_{MAX} * Size_{NAK} $ ~~* 2~~ $)) + (0,1 * Timeout_{CONST})$~~seconds~~

EDITORTAL NOTE: Without the strikeouts, the formula reads

$$Timeout_{ACK} = (Timeout_{COEFF} * Period) * (Size_{MAX} + (Offset_{MAX} * Size_{NAK})) + (0,1 * Timeout_{CONST}).$$

Where:

$Timeout_{ACK}$ is the minimum time-out period in seconds.

$Timeout_{COEFF}$ is the time-out coefficient.

Period is the time per byte calculated as (10 / Baud Rate) and is expressed in seconds per byte.

$Size_{MAX}$ is the ~~M~~maximum ~~P~~payload ~~S~~size negotiated with the Port Login process, plus SOF, EOF, ADT Header, and checksum bytes (see 6.1).

$Offset_{MAX}$ is the maximum ACK offset negotiated with the Port Login process (see 4.4).

$Size_{NAK}$ is the size in bytes of the NAK IU including SOF, EOF, and checksum bytes (see 6.5.3.3).

$Timeout_{CONST}$ is the constant portion of the time-out, in seconds.

For example, at 9 600 Baud with a time-out coefficient of 2, a negotiated Maximum Payload Size of 1 024, a ~~and~~ Maximum ACK Offset of 2 and a time-out constant of 1, the minimum timeout period would be approximately 2,28 seconds.

Figure 9 — Minimum acknowledgement time-out period

6.5.1 Link service frames overview

Frame Type	Description
0h	ACK (acknowledge)
1h	NAK (negative acknowledge)
2h	Port login
3h	Port logout
4h	Pause
5h	NOP (no operation)
6h	Initiate recovery
7h	Initiate recovery ACK (acknowledgement)
8h	Initiate recovery NAK (negative acknowledgement)
9h	Device Reset IU
Ah	Time-out parameters
~~A~~Bh - Fh	Reserved

6.5.4 Port login information unit

The BAUD RATE field indicates the speed that the port's physical interface shall run after completion of negotiation. The BAUD RATE field contains the desired nominal Baud rate divided by 100. All ports shall default to operating at 9 600 Baud at power-up and following error conditions that require re-establishment of the negotiated operating parameters (see 4.6.2). If a port receives a Port Login IU containing a baud rate value less than 9 600 it shall respond with a NAK IU with a status code of NEGOTIATION ERROR (see table 14) and transition to N1:Negotiating to initiate a new login exchange.

6.5.13 Time-out parameters information unit

A port may send a Time-out Parameters IU to:

a)   Request that the other device's port send a list of the time-out parameter values that it supports;

b)   Set the time-out parameters of the other device's port; or

c)   Send a list of the time-out parameter values that the sending port supports.

Table Y defines the payload of the Time-out parameters IU.

Table Y –Time-out parameters IU payload contents

Bit / Byte	7	6	5	4	3	2	1	0
0	SET	REQUEST	Reserved				Vendor Specific	
1	Reserved							
2	(MSB)	DESCRIPTOR LIST LENGTH (n-3)						
3								(LSB)
	Time-out descriptor list							
4	Time-out descriptor (first)							
7								
	. . .							
n-3	Time-out descriptor (last)							
n								

A REQUEST bit of one specifies that the receiving port shall send a Time-out Parameter IU containing the list of time-out parameter values it supports to the other port. The Time-out Parameter IU containing the list of time-out parameter values shall have the REQUEST and SET bits set to zero. A REQUEST bit of zero specifies that the receiving port shall not send a Time-out Parameter IU containing the list of time-out parameter values it supports to the other port.

A SET bit set to one specifies that the receiving port shall set its time-out parameters to the values contained in the time-out descriptor. A SET bit set to zero specifies that the receiving port shall not set its time-out parameters to the values contained in any descriptor contained in the time-out descriptors list.

The DESCRIPTOR LIST LENGTH field indicates the length, in bytes, of the time-out descriptor list.

Table Y+1 defines the Time-out descriptor format.

Table Y+1 – Time-out descriptor format

Bit / Byte	7	6	5	4	3	2	1	0
0	Reserved							
1	MAX CONST	MIN CONST	Reserved		TIME-OUT COEFFICIENT			
2	(MSB)	TIME-OUT CONSTANT						
3								(LSB)

The TIME-OUT COEFFICIENT field specifies the value of the coefficient portion of the minimum acknowledgement IU time-out period, Timeout$_{COEFF}$ (see 4.6.1.2.2). A port may use this parameter to account for its per-symbol processing overhead.

A MIN CONST bit set to one specifies that the value in the TIME-OUT CONSTANT field is the inclusive lower bound of a contiguous range of time-out constant values that the sending port supports for the given time-out coefficient. A MIN CONST bit set to zero specifies that the value in the TIME-OUT CONSTANT field is not an inclusive lower bound.

A MAX CONST bit set to one specifies that the value in the TIME-OUT CONSTANT field is the inclusive upper bound of a contiguous range of time-out constant values that the sending port supports for the given time-out coefficient. A MAX CONST bit set to zero specifies that the value in the TIME-OUT CONSTANT field is not an inclusive upper bound.

The TIME-OUT CONSTANT field specifies the value of the constant portion of the minimum acknowledgement IU time-out period, Timeout$_{CONST}$, in seconds (see 4.6.1.2.2). A port may use this parameter to account for its per-IU processing overhead.

Upon receiving a Time-out Parameters IU a port shall send a NAK IU with a status code of INVALID OR ILLEGAL IU RECEIVED (see table 14) if:

a) The REQUEST bit is set to one and the SET bit is set to one;

b) The REQUEST bit is set to one and the DESCRIPTOR LIST LENGTH field is set to a non-zero value;

c) The SET bit is set to one and the DESCRIPTOR LIST LENGTH field is set to a value other than one;

d) The SET bit is set to one and either the MIN CONST bit or the MAX CONST bit are set to one; or

e) The SET bit is set to one and the receiving port does not support the combination of values in the TIME-OUT COEFFICIENT and TIME-OUT CONSTANT fields.

C.4 Automation device initiates login after power-up

7) Upon receiving the Port Login IU, the automation device port sends an ACK IU with X_ORIGIN, EXCHANGE ID, and FRAME NUMBER fields that match the Port Login IU it received. The automation device port then inspects the Port Login IU it received. Since it is part of the exchange the automation device had originated, it is a continuation of the negotiation already in progress. The ACCEPT bit set to one and no other parameters have changed indicates the negotiation process is complete. After it has successfully sent the ACK IU, the automation device port changes its negotiated operating parameters to match the negotiated values; and

8) Upon receiving the ACK IU for the final Port Login IU, the DT device port changes its negotiated operating parameters to match the negotiated values.